App. Serial No. 09/877,724
Docket No. STFD.059PA
Preliminary Amendment

In the Claims

Please amend the claims as indicated and add new claims 21-62. This listing of claims replaces all previous claim listings.

1. (currently amended) A method of controlling a digital communication system having a plurality of communication lines on which signals are transmitted and received, the signals being affected by interference during transmission, each of the communication lines being used by a user and having at least one transmitter and at least one receiver, the method comprising the steps of:

[[--]] collecting information about line, signal and interference characteristics of the communication lines;

[[--]] creating a model of the line, signal and interference characteristics of the communication lines;

[[--]] synchronizing transmissions of signals between transmitters and receivers; and

[[--]] processing signals using the model to remove interference from signals.

2. (original) The method of Claim 1 wherein the digital communication system is a DSL system.

3. (original) The method of Claim 1 wherein the step of processing signals using the model is performed prior to transmission of a signal.

4. (original) The method of Claim 1 wherein the step of processing signals using the model is performed after reception of the signals.

5. (original) The method of Claim 1 wherein the step of synchronizing transmissions of signals comprises using block transmission and reception.

6. (original) The method of Claim 1 wherein the interference affecting transmission of signals includes crosstalk from communication lines adjacent the communication line on which the signal is sent.

7. (original) The method of Claim 1 wherein the digital communication system uses discrete multitone transmission and the step of processing signals using the model to remove interference from signals is done on a tone by tone basis.

8. (original) The method of Claim 1 wherein the step of processing signals using the model to remove interference from signals comprises canceling crosstalk interference in signals by QR decomposition.

9. (original) The method of Claim 1 wherein the step of collecting information about line, signal and interference characteristics of the communication lines is performed by a party other than one of the users.

10. (original) The method of Claim 1 wherein each user is permitted to transmit and receive signals using a data rate and wherein the step of processing signals using the model to remove interference from signals comprises maximizing a weighted sum of the data rates of the users.

11. (original) The method of Claim 10 wherein the step of maximizing the weighted sum of the data rates of the users comprises allocating energy to each user for transmission of signals.

12. (original) The method of Claim 1 wherein the signals are sent using a plurality of frequencies and further wherein the step of processing signals using the model to remove interference from signals comprises dynamically adjusting the frequencies used to send the signals.

13. (currently amended) A method of controlling a digital communication system having a plurality of communication lines, each of the communication lines being used by a user, wherein ~~the total power a user can~~ a user's available total power for use in the system is limited by a power constraint, the method comprising the steps of:

[[--]] assigning the total power constraint for each user an initial value;

[[--]] determining a competitively optimal data rate for each user, ~~comprising~~including the steps of:

[[--]] determining a power allocation within the total power constraint of each user by iteratively allowing each user to optimize its power allocation; and

[[--]] determining the competitively optimal data rate for each user based on the determined power allocation for the user; and

[[--]] evaluating the competitively optimal data rate for each user, ~~comprising~~including the steps of:

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[[--]] comparing the competitively optimal data rate of a user with a target rate for the user;

[[--]] increasing the power constraint for a user if the competitively optimal data rate of the user is less than the target rate for the user;

[[--]] decreasing the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by at least a prescribed variance;

[[--]] maintaining the power constraint for the user if the competitively optimal data rate of the user is equal to the target rate for the user; and

[[--]] maintaining the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by less than the prescribed variance.

14. (currently amended) The method of Claim 13 wherein the steps of determining a competitively optimal data rate for each user and evaluating the ~~power constraint~~competitively optimal data rate for each user are repeated until no power

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constraint is increased or decreased.

15. (original) The method of Claim 13 wherein the digital communication system is a DSL system.

16. (original) The method of Claim 13 wherein the total power allowed each user is allocated among a plurality of frequencies.

17. (original) The method of Claim 13 performed by a single entity.

18. (original) The method of Claim 13 performed by the users in a distributed fashion.

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19. (currently amended) The method of Claim 13 wherein crosstalk interference is injected into the communication line of a user by at least one of the lines of another user, and ~~further~~ wherein the crosstalk interference is considered by a user in the step of determining the power allocation of the user.

20. (original) The method of Claim 13 wherein each user uses a modem having a power limit and wherein the power constraint of a user will not be increased to a level greater than the modem power limit irrespective of the competitively optimal data rate of the user.

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21. (new) A method of controlling a digital communication system having a plurality of communication lines on which signals are transmitted and received, the signals being affected by interference during transmission, each of the communication lines being used by a user, the method comprising:

creating a model of line, signal and interference characteristics of the communication lines based on signals carried by the communication lines; and

processing signals using the model to remove interference from signals.

22. (new) The method of Claim 21 wherein the digital communication system is a DSL system.

23. (new) The method of Claim 21 wherein the step of processing signals using the model includes modifying a signal prior to transmission of the signal.

24. (new) The method of Claim 21 wherein the step of processing signals using the model includes removing interference from a signal after reception of the signal.

25. (new) The method of Claim 21 further including the step of synchronizing transmissions of signals using block transmission and reception.

26. (new) The method of Claim 21 wherein the interference affecting transmission of signals includes crosstalk from adjacent ones of the communication.

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27. (new) The method of Claim 21 wherein the digital communication system uses discrete multitone transmission and the step of processing signals using the model to remove interference from signals is done on a tone by tone basis.

28. (new) The method of Claim 21 wherein the step of processing signals using the model to remove interference from signals comprises canceling crosstalk interference in signals by matrix decomposition.

29. (new) The method of Claim 21 further including the step of collecting information about line, signal and interference characteristics of the communication lines at a location other than a location of one of the users.

30. (new) The method of Claim 21 wherein each user is permitted to transmit and receive signals using a data rate and wherein the step of processing signals using the model to remove interference from signals comprises maximizing a weighted sum of the

data rates of the users.

31. (new) The method of Claim 30 wherein the step of maximizing the weighted sum of the data rates of the users comprises allocating energy to each user for transmission of signals.

32. (new) The method of Claim 21 wherein the signals are sent using a plurality of frequencies and further wherein the step of processing signals using the model to remove interference from signals comprises dynamically adjusting the frequencies used to send the signals.

33. (new) A method of controlling a digital communication system having a plurality of communication lines, each of the communication lines being used by a user, wherein a user's available total power for use in the system is limited by a power constraint, the method comprising:

assigning the total power constraint for each user an initial value;

determining a competitively optimal data rate for each user, including:

determining a power allocation within the total power constraint of each user by iteratively allowing each user to optimize its power allocation; and

determining the competitively optimal data rate for each user based on the determined power allocation for the user; and

evaluating the competitively optimal data rate for each user, including:

comparing the competitively optimal data rate of a user with a target rate for the user;

increasing the power constraint for a user if the competitively optimal data rate of the user is less than the target rate for the user;

decreasing the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by at least a prescribed variance;

maintaining the power constraint for the user if the competitively optimal data rate of the user is equal to the target rate for the user; and

maintaining the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by less than the prescribed variance.

34. (new) The method of Claim 33 wherein the steps of determining a competitively optimal data rate for each user and evaluating the competitively optimal data rate for each user are repeated until no power constraint is increased or decreased.

35. (new) The method of Claim 33 wherein the digital communication system is a DSL system.

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36. (new) The method of Claim 33 wherein the total power allowed each user is allocated among a plurality of frequencies.

37. (new) The method of Claim 33 performed by a single entity.

38. (new) The method of Claim 33 performed by the users in a distributed fashion.

39. (new) The method of Claim 33 wherein crosstalk interference is injected into the communication line of a user by at least one of the lines of another user, and wherein the crosstalk interference is considered by a user in the step of determining the power allocation of the user.

40. (new) The method of Claim 33 wherein each user uses a modem having a power limit and wherein the power constraint of a user will not be increased to a level greater than the modem power limit irrespective of the competitively optimal data rate of the user.

41. (new) An arrangement for controlling communication in a digital communication system having a plurality of communication lines on which signals are transmitted and received, the signals being affected by interference during transmission, each of the communication lines being used by a user, the arrangement comprising:

a first processing arrangement adapted to create a model of line, signal and interference characteristics of the communication lines based on signals carried by the communication lines; and

a second processing arrangement adapted to process signals using the model to remove interference from signals.

42. (new) The arrangement of Claim 41 wherein the digital communication system is a DSL system.

43. (new) The arrangement of Claim 41 wherein the second processing arrangement is further adapted to use the model for modifying a signal prior to transmission of the signal.

44. (new) The arrangement of Claim 41 wherein the second processing arrangement is further adapted to use the model for removing interference from a signal after reception of the signal.

45. (new) The arrangement of Claim 41 further including at least one block adapted to synchronize transmissions of signals using block transmission and reception.

46. (new) The arrangement of Claim 41 wherein the interference affecting transmission of signals includes crosstalk from adjacent ones of the communication lines.

47. (new) The arrangement of Claim 41 wherein the digital communication system uses discrete multitone transmission and using the model to remove interference from signals is performed on a tone by tone basis.

48. (new) The arrangement of Claim 41 wherein the second processing arrangement is further adapted to use the model for canceling crosstalk interference in signals by matrix decomposition.

49. (new) The arrangement of Claim 41 further including at least one block adapted to operate independent from other users and adapted to collect information about line, signal and interference characteristics of the communication lines.

50. (new) The arrangement of Claim 41 wherein each user is permitted to transmit and receive signals using a data rate and wherein the second processing arrangement is further adapted to maximize a weighted sum of the data rates of the users.

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51. (new) The arrangement of Claim 50 wherein the second processing arrangement is further adapted to allocate energy to each user for transmission of signals.

52. (new) The arrangement of Claim 41 wherein the signals are sent using a plurality of frequencies and further wherein the second processing arrangement is further adapted to dynamically adjust the frequencies used to send the signals.

53. (new) An arrangement for controlling a digital communication system having a plurality of communication lines, each of the communication lines being used by a user, wherein a user's available total power for use in the system is limited by a power constraint, the arrangement being adapted and programmed to perform the following steps:

assigning the total power constraint for each user an initial value;

determining a competitively optimal data rate for each user, including:

determining a power allocation within the total power constraint of each user by iteratively allowing each user to optimize its power allocation; and

determining the competitively optimal data rate for each user based on the determined power allocation for the user; and

evaluating the competitively optimal data rate for each user, including:

comparing the competitively optimal data rate of a user with a target rate for the user;

increasing the power constraint for a user if the competitively optimal data rate of the user is less than the target rate for the user;

decreasing the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by at least a prescribed variance;

maintaining the power constraint for the user if the competitively optimal data rate of the user is equal to the target rate for the user; and

maintaining the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by less than the prescribed variance.

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54. (new) The arrangement of Claim 53 wherein the steps of determining a competitively optimal data rate for each user and evaluating the competitively optimal data rate for each user are repeated until no power constraint is increased or decreased.

55. (new) The arrangement of Claim 53 wherein the digital communication system is a DSL system.

56. (new) The arrangement of Claim 53 wherein the total power allowed each user is allocated among a plurality of frequencies.

57. (new) The arrangement of Claim 53 performed by a single entity.

58. (new) The arrangement of Claim 53 performed by the users in a distributed fashion.

59. (new) The arrangement of Claim 53 wherein crosstalk interference is injected into the communication line of a user by at least one of the lines of another user, and wherein the crosstalk interference is considered by a user in the step of determining the power allocation of the user.

60. (new) The arrangement of Claim 53 wherein each user uses a modem having a power limit and wherein the power constraint of a user will not be increased to a level greater than the modem power limit irrespective of the competitively optimal data rate of the user.

61. (new) An arrangement for controlling communication in a digital communication system having a plurality of communication lines on which signals are transmitted and received, the signals being affected by interference during transmission, each of the communication lines being used by a user, the arrangement comprising:

means for creating a model of line, signal and interference characteristics of the communication lines based on signals carried by the communication lines; and

means for processing signals using the model to remove interference from signals.

62. (new) An arrangement for controlling a digital communication system having a plurality of communication lines, each of the communication lines being used by a user, wherein a user's available total power for use in the system is limited by a power constraint, the arrangement being adapted and programmed to perform the following steps:

means for assigning the total power constraint for each user an initial value;

means for determining a competitively optimal data rate for each user, including:

determining a power allocation within the total power constraint of each user by iteratively allowing each user to optimize its power allocation; and

determining the competitively optimal data rate for each user

based on the determined power allocation for the user; and

means for evaluating the competitively optimal data rate for each user and including:

comparing the competitively optimal data rate of a user with a target rate for the user;

increasing the power constraint for a user if the competitively optimal data rate of the user is less than the target rate for the user;

decreasing the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by at least a prescribed variance;

maintaining the power constraint for the user if the competitively optimal data rate of the user is equal to the target rate for the user; and

maintaining the power constraint for the user if the competitively optimal data rate of the user exceeds the target rate for the user by less than the prescribed variance.